

# Atomic Parameters

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Consider an ion with  $N$  nucleons,  $Z$  protons, and  $(Z - Q)$  electrons. The net charge of the ion is  $eQ$  where  $e$  is the charge of a single proton. The mass of the ion is

$$m = au - Qm_e + E_b/c^2 \quad (1)$$

where  $a$  is the atomic mass [1, 2] of the neutral atom,  $u = 931.494013(37)$  is the unified atomic mass unit [3], and  $m_e = 0.510998902(21) \text{ MeV}/c^2$  is the electron mass [3].  $E_b$  is the binding energy of the  $Q$  electrons removed from the neutral atom. This will be neglected except for the case of  $\text{H}^+$  and  $\text{D}^+$  ions. Here one uses the proton and deuteron masses [3]  $m_p = 938.271998(38) \text{ MeV}/c^2$  and  $m_d = 1875.612762(75) \text{ MeV}$ . Table 1 lists the values of  $a$ ,  $N$ , and  $Z$  for various atoms.

## References

- [1] David R. Lide (Editor-in-Chief), Handbook of Chemistry and Physics, 80th Edition, 1999–2000, CRC Press LLC, 1999, pp. 1-10 through 1-12.
- [2] M.A. Zucker and R.A. Dragoset (2000). Elemental Data Index (Version 1.1), [Online]. Available: <http://physics.nist.gov/EDI> [2000, September 6]. National Institute of Standards and Technology, Gaithersburg, MD.
- [3] D.E. Groom, et al., The European Physical Journal C 15, 73 (2000)

Table 1: Atomic Parameters

Atom	Symbol	Atomic Mass $a$	$N$	$Z$
Hydrogen	H	1.0078250321(4)	1	1
Deuterium	D	2.0141017780(4)	2	1
Helium	He	4.0026032497(10)	4	2
Carbon	C	12.0000000000	12	6
Oxygen	O	15.9949146221(15)	16	8
Fluorine	F	18.99840320(7)	19	9
Silicon	Si	27.9769265327(20)	28	14
Sulfur	S	31.97207069(12)	32	16
Chlorine	Cl	34.96885271(4)	35	17
Titanium	Ti	47.9479471(10)	48	22
Iron	Fe	55.9349421(15)	56	26
Cobalt	Co	58.9332002(15)	59	27
Nickel	Ni	57.9353479(15)	58	28
Copper	Cu	62.9296011(15)	63	29
Bromine	Br	78.9183376(20)	79	35
Silver	Ag	106.905093(6)	107	47
Iodine	I	126.904468(4)	127	53
Gold	Au	196.966552(3)	197	79